

Aerodynamic stability of long-span box girder

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AERODYNAMIC STABILITY OF LONG-SPAN BOX GIRDER

Tozaki Bridge is the north approach to Oharanuto Br. (suspension bridge) of Kobe-Naruto Route, Honshu-Shikoku Bridge Project, Japan. Tozaki Bridge is 2 sets of continuous box girders and has slender configuration with large overhanging brackets.

The bridge was to be constructed along a steep ridge called Tozaki which faces the Pacific Ocean.

Thus, strong wind is expected so that the basic wind speed which is defined as 10 minutes average speed expected to occur once or twice in 150 years is decided to be 50m/s.

And, bad influence by the topography was also anxious.

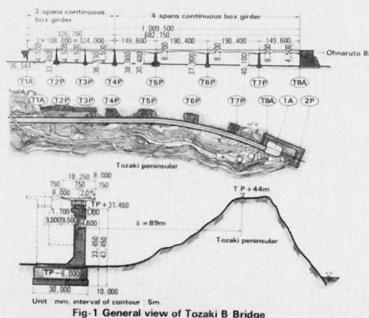
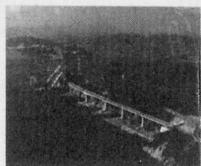


Fig. 1 General view of Tozaki B Bridge

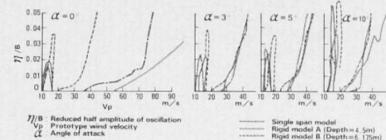


Fig. 2 Response of original section (without topography)

The original section was suspected to have unstable aerodynamic behavior, so, wind tunnel tests were conducted to reveal that the original section had vortex-induced oscillation at the wind speed of 15 to 20 m/s and galloping which should not occur below the speed of 92 m/s (10 minutes average), the dynamic design wind speed.

Various stabilizers and their effects were tested in wind tunnels.

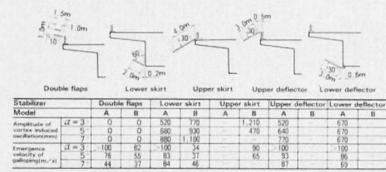


Fig. 3 Effect of lower skirt (model B)

Table 1 Various stabilizers and their effects (rigid models)

Model Double Flaps Lower skirt Upper skirt Upper deflector Lower deflector

Amplitude of vortex-induced oscillation (mm/mm)

Emergency velocity (galloping/m/s)

Distance between the ridge and the bridge (m)

Height of double flaps (mm)

Location of accelerometers

Location of anemometers

1.000.0 m

No. of Lower Skirts

T1P T2P T3P T4P T5P T6P T7P T8P T9A

● Location of accelerometers

○ Location of anemometers

1.000.0 m

Double Flaps

Lower skirt Maintenance walk (2m x 4m)

Detail of double flaps (mm)

1.000.0 m

Double Flaps

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